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**NEIS**  
**(NASA Environmental Information System)**

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**Abstract**

The NASA Environmental Information System (NEIS) is a tool to support the functions of the NASA Operational Environment Team (NOET). The NEIS is designed to provide a central environmental technology resource drawing on all NASA centers' capabilities, and to support program managers who must ultimately deliver hardware compliant with performance specifications and environmental requirements. The NEIS also tracks environmental regulations, usages of materials and processes, and new technology developments. It has proven to be a useful instrument for channeling information throughout the aerospace community, NASA, other federal agencies, educational institutions, and contractors. The associated paper will discuss the dynamic databases within the NEIS, and the usefulness it provides for environmental compliance efforts.

**Evolution of NEIS**

In April of 1992, Mr. Goldin, the NASA Administrator, instructed MSFC to proceed with an Agency-wide environment effort. The NASA Operational Environment Team (NOET) was created and given the responsibility to maintain environmental compliance in all operational areas including the design, development, test, production, and use of space flight hardware. The NOET's approach to handle this responsibility is to provide a central environmental technology resource among the many NASA projects to pursue cleaner propulsion systems and to pursue replacement technology for environmentally affected materials and processes.

To disperse the rapidly developing technology among all projects with similar needs, NOET periodically holds Technology Interchange Meetings (TIMs) at which individuals working similar problems can discuss their technology activities. However, another mechanism for providing information on technological advancements was necessary. In addition to technical interchanges for dissemination of replacement technology activities, a NASA-wide environmental database has been established, is updated periodically, and is available to NASA and aerospace contractors. Information from NASA, contractors, and vendor research and development efforts is provided to NOET for addition into the database, titled the NASA Environmental Information System (NEIS).

**Structure of NEIS**

NEIS is one of three components in a larger information system called the Materials, Processes, and Environmental Engineering Network, or MPEEN. MPEEN is maintained at NASA's Marshall Space Flight Center (MSFC) in Huntsville, Alabama by the Materials and Processes Laboratory. Within this

vast information storage, display and retrieval system are volumes of data on environmental replacement materials information, metallic and non-metallic materials properties, failure analysis research, foreign alloy cross-referencing, specifications and standards, long-duration exposure facility, and more. Once the MPEEN system has been accessed, this information can be reached through three distinct nodes: the Materials & Processes Technical Information System (MAPTIS), Failure Analysis Information System (FAIS), and NEIS. A graphical depiction of the information system's interactive relationship can be seen in Figure 2.

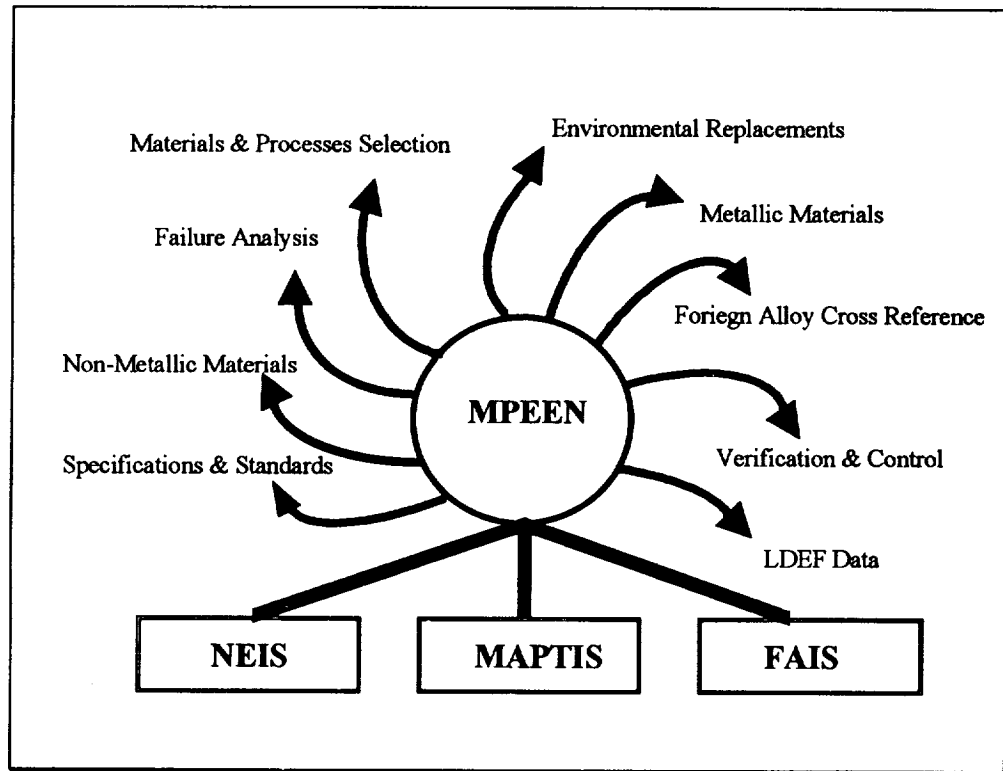


Figure 1

### Contents of NEIS

NEIS is designed to provide a central environmental technology resource for all centers and their contractors; to track and access environmental regulations, chemical usages, and environmental technology development; to support program managers who must deliver environmentally compliant hardware; and to provide communication within NASA and among NASA, other agencies, contractors, and educational institutions. To do this, the NEIS keeps tabs on environmentally compliant research and technology designed to replace current aerospace materials and processes. Figure 1 shows the complete set of options available through NEIS as they appear in the NEIS Main Menu.

### NEIS Main Menu Options:

1. Regulatory Updates
2. ODS Specifications & Standards
3. NASA-wide ODS Usage
4. Replacement Solvent Summaries
5. Material/Processes Replacement Prioritization Matrix
6. Chemical & Physical Properties
7. Points of Contact
8. Program Tasks
9. In-house Activities
10. Workshop/Conference Minutes
11. Calendar of Events

Figure 2

The **Program Tasks** option of NEIS provides a comprehensive look at each replacement activity NOET monitors within the Shuttle projects. External Tank is developing a new formulation for their foam blowing agent to eliminate CFC-11. Environmentally-friendly solvents are being evaluated to replace CFC-113 and TCA which are currently used in handwipe cleaning operations. High pressure water blast and other methods are being studied to replace current vapor degreasing operations. These activities and more are documented in the Program Tasks option of NEIS. Information can be queried by the task title, the contractor involved, the targeted chemical being eliminated or reduced, or the area of environmental impact. A synopsis of efforts to date and current funding status can also be found here.

The **ODS Specifications and Standards** option contains the results of NOET's 1993 survey in this area. Over 400 documents were identified in this survey, and of those, only 71 identified NASA as the custodian. However, more comprehensive research has since revealed that NASA may need to revise 107 documents total. Many of these changes have already been made and have thus reduced the number of required revisions. Impacted documents can be retrieved from the NEIS by their title, number, or custodian. Other information provided includes an abstract, identified NASA users of the document (by centers), targeted ODS chemical referenced, and forbidden chemicals and suggested alternatives as identified in the document. This data option contains all documents referenced by the survey. They include NASA-owned standards, military specifications, contractor documents, and more.

The **Regulatory Update** option provides informal summaries of interactions with EPA and federal and state regulations. For example, status's of the Thiokol Essential Use Exemption Request and of NOET's discussions with EPA on the NESHAP for Aerospace Manufacture and Rework are available. Forthcoming NESHAPs and CTGs will also be referenced here. These summaries can be queried by keywords, title, or source of information. Each record contains a summary or status of events to date. Older selections may contradict newer inputs if regulations have been updated or changed.

The NOET-sponsored workshops are cataloged in the **Workshop/Conference Topics** option. For each event, be it a Technical Interchange Meeting, a Video Teleconference, or an All-Centers' Meeting, and agenda of the activities as well as an abstract of each topic is available. This information

can be queried by the event title, the presentation title, date of that event, or speaker name/organization.

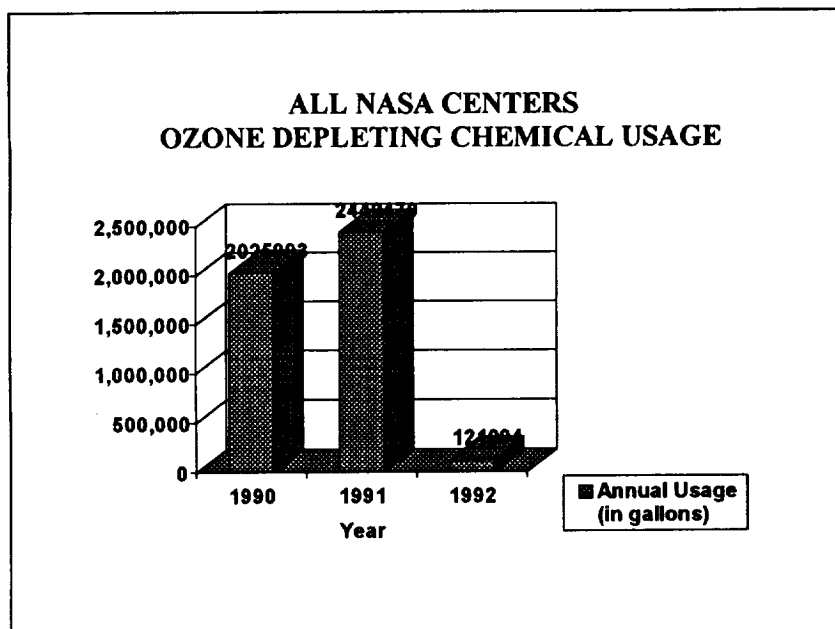


Figure 3

Another useful option is the **NASA-wide ODS Usage**. A user can look at the annual usage trends for each center or for all NASA through this selection. The information is represented by bar graph for the years 1990, 1991, and 1992. Unfortunately, NASA did not

conduct a usage survey for 1993 so data from that year is unavailable. An example of output from this menu option is provided in Figure 3.

Another option within the NEIS is the **Material/Processes Replacement Prioritization Matrix**. This option opens to the user an automated tool for evaluation and prioritization of alternative materials and processes. The analysis is performed based on a Quality Function Deployment (QFD) method of optimization. The series of forms will direct the user to identify a material or process to be replaced. The next step is to identify all areas of concern with the material or process and to assign weighting factors to each concern. These concerns fall into several categories: Regulatory, Process, Chemical, Safety, Environmental, Cost, and Scheduling. This allows the user to list all criteria the replacement must meet and to identify how important each area of concern is to the acceptance of the replacement. For example, if CFC-113 is being replaced as a handwipe, toxicity might rate higher than evaporation rate (as a chemical concern) because of the close proximity in which the operator will be using the handwipe cleaner. Of course safety concerns should also be considered in this situation. This example demonstrates how some concerns are greater issues than others and should be weighted accordingly, and it demonstrates how looking at some concerns can lead to looking at others.

Once all the concerns have been identified and weighted, the user can list each potential replacement and for each concern, can assign a number to rate its ability that previously selected criteria. After all the potential replacements have been added to the system, the user can run a report to determine the optimal solution. To do this, the program multiplies the weighting factor by the rating a potential replacement scored. These products are then tallied per potential replacement and the results are provided in a well organized report. The scoring of each potential replacement on each concern can also be studied by running a long report.

Only six of the NEIS options have been discussed at this point, but the other five options are also available. Two of the remaining five provide lists on points of contacts and upcoming events related to NASA's environmental activities. The **Replacement Solvent Summaries** option lists a variety of materials which have been tested to replace some cleaning solvent or process to be eliminated. Along with the list of materials is a denotation of whether the material passed or failed the particular criteria for that situation, and the name of the person who conducted that test. This is a quick way for one to get a feel for what type of replacements with which to begin a private evaluation as well as a point of contact to gather details about testing already performed. One option, the **Chemical & Physical Properties**, provides a look at some basic properties of various replacement solvents and the materials to be phased-out. Finally, the **In-house Activities** provides a quick summary of replacement activities underway "in-house" throughout the NASA centers.

### **Future of NEIS**

Two major activities will be on-going through the remainder of 1994 to enhance the capabilities of the NEIS. First is the upgrading of the existing MPEEN system. Second is the inclusion of the Aero-Mat database into the existing NEIS.

The MPEEN system currently has a storage capacity of five Gigabytes, a memory capacity of 64Km and an operating speed of 28 MIPS. The system accommodates many users and during prime operating hours, commands are processed rather slowly. An upgrade has been purchased from Digital Corporation from the Alpha 7000 series which is currently on the market. The new system has a storage capacity of six to over 100 Gigabytes, a memory capacity of 128M to two Gigabytes, and an operating speed of 150 to 200 MIPS. This Alpha 7000 upgrade will replace the existing VAX computer cluster system as the active system to be accessed by users. The existing VAX cluster will be used off-line for development of new programs and tasks.

The Aero-Mat Database is a tool that was developed off-line, in a PC environment, for quick accessibility and manipulation of data. This database houses material names, manufacturers, VOC content, annual usage, as well as other data pertinent to aerospace material usage on production lines. Materials included in the data include cleaners, paint thinners, various specialty coatings, foams, adhesives, and sealants. This data has been used to aid the NOET as it evaluates proposed regulations and discusses NASA's unique needs with EPA. This data has proven helpful in justification of the aerospace community's special technical requirements. The data has been compiled from many Centers and contractor facilities. Now that it is in a manageable format, it will be stored within the MPEEN system. With this additional information, the NEIS can address environmental compliance issues other than ODC replacement.

These two expansions of the NEIS will add to its capabilities and to its usefulness. The merging of the Aero-Mat Database with the existing NEIS should take place during the Fall of 1994, and the VAX system improvements are expected to be in place during the 1995 fiscal year. The NEIS is an ever-growing, ever-improving, data storage system which strives to accommodate the varied needs of process engineers, program managers, and materials specialists as they address the increasing requirements for environmental compliance. The demands placed on manufacturers of all types, both federally and locally, are growing increasingly stringent with each issuance of regulation from the EPA. Small businesses do not have the manpower or other resources to independently address all replacement issues, and large companies do not have the budgetary freedom to explore all alternative options. This NEIS provides individuals from various situations with the opportunity to learn from other's activities without unnecessarily duplicating effort. With today's tight budgetary constraints, this opportunity is critical to the survival of many processes and procedures.

